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Centre of Research for Development

UNIVERSITY OF KASHMIR



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REPORT



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## **Centre of Research for Development (CORD)** **University of Kashmir, Srinagar-6**

The primary function of a University is to train young men and women required by the nation for its many activities. In higher education, Ph. D. programmes in science and technology aim at the following objectives:

- a) to create new knowledge,
- b) to develop new processes, and
- c) to produce personnel who will transfer knowledge to others.

Although most of our universities are performing the above functions well, we often hear the charge that scientific research in India is not relevant or that it does not significantly contribute to the development of the country.

In India, the bulk of applied research is carried out in laboratories set up by the government under agencies like the Council of Scientific and Industrial Research, the Councils of Agricultural or Medical Research, and similar laboratories of the state governments. These laboratories are, by and large, single discipline units, whereas most problems of development in this country, as anywhere else, are multidisciplinary in character. In a university, on the other hand, one has to have many scientific disciplines and in principle, therefore, it should be a more appropriate place for undertaking work of this nature aimed at tackling problems of development.

With this in view the then Vice-chancellor of the University

of Kashmir, Professor Rais Ahmed, conceived the idea of starting a separate research centre in the campus to undertake work on problems of development of the region in the State of Jammu and Kashmir. In 1978, he convened a meeting of several senior government officials and scientists of the region to solicit their advice in the matter. He then approached the University Grants Commission (UGC) for assistance. The UGC, on the advice of its expert committee, sanctioned in 1979 the setting up of the Centre with some core staff and funds for equipment.

The University set up a number of working groups in areas suggested by the UGC Committee. In July, 1979, the University and the Bhabha Atomic Research Centre, (BARC) Bombay, arranged a two-day workshop on "Application of Nuclear and other Techniques to Problems of Regional Development" at which many scientists and officers of State Government, the University and BARC participated. This group recommended specific research problems which may be undertaken. The Centre started functioning later that year in the Naseem-Bagh Campus in part of a hut (No. 52). Another was built for the Centre a year later.

### **The Motivation of Establishing C O R D**

In the large policy making meeting in 1978, the importance of **linking** Education (E), production including services (P), and Research (R) was emphasized since, in isolation, each one of these activities suffered. Through a linked system it was desired to examine scientific and technological problems of regional development. The name CORD (link) indicates cooperation, coordination and team work across boundaries of departments and faculties, University vis-a-vis laboratories of Central or State Agencies. This is a joint endeavour to share knowledge of regional problems, to share the task of solving them and to share facilities. It is an antidote for individualism, isolation and mere credit snatching.



### **General Operational Features :**

In the last nearly three years we have come to have a three tier arrangements :

- (a) A General Body of Scientists, technologists and science and technology administrators to meet once a year to review, and suggest overall lines of approach - policy, planning, funding, working of the system to serve the ends of S & T involvement in regional development.
- (b) A series of Working Groups for specific fields of scientific/economic activity - consisting of experts from within Kashmir and the country as a whole - to identify problems for cooperative research and studies in some depth, and to suggest where and by whom should these problems be worked on.
- (c) A research base, a laboratory with staff and equipment so as to supplement (not duplicate) the existing facilities in the University, or in the Kashmir/Ladakh region of the state.

It is of some encouragement to us that these overall objectives and this model of serving the purpose has found general support from the UGC, and the Sixth Plan working groups on Science and Technology and Education Employment and Development. It is likely that during the Plan other similar organizations will be set up to participate in developmental activities of other regions and, may be, a mechanism of all-India clearing house or cooperations will also be set up.

### **C O R D and its Working**

Certain things flow from the above regarding CORD whose first responsibility is to service the (a) and (b) levels so that the purpose of the whole set up is implemented.

A separate Board of Research Studies (BORS) had been set

up so that admissions to research may take place in pursuance of identified problems - and not only that, to see that the entire emphasis is not on Ph. D. alone - relevant shorter or longer studies needed to support S & T vis-a-vis development should also be taken up. The BORS is to coordinate the outcome of Working Groups, parcel out tangible problems for research, take up research in its own laboratories on some of these problems and help and support research on these problems by the Departments, Faculties (particularly, engineering, medicine, agriculture, social sciences), and the other laboratories or research stations in the State. BORS is now being renamed "Research Advisory Committee"

The CORD's own laboratories and staff are not a teaching department; they are non-vacation and they are project oriented. Thus the primary duty of academic staff is to attack problems in the spheres for which they were recruited. They should be judged by these contributions alone and not by the number of M. Phils or Ph.Ds they produce. The technical staff are a pool of technicians who should be identified with specific skills and detailed for work on related problems under whoever is leading that work - in CORD's own laboratory or in the Departments, Faculties and elsewhere.

CORD has limited funds at its disposal, but they are provided for flexible use. So while using these funds to the maximum extent in pursuance of the objectives, CORD helps the scientists draw up schemes corresponding to the identified problems and submit them to the various agencies for support. For this purpose it keeps in touch with the Agencies so as to have their relevant forms, priorities and policies for reference. But, out of existing resources, co-operative scientific work has taken the following forms: (i) training of technical or other staff for relevant skills (no matter where particularly in the Faculties of the University where such staff is working), (ii) placement of STA's and JTA's with the identified leader of relevant research - irrespective of his place of work; (iii) providing small contingent expenditure for laboratory or field work where there

is no other fund available; (iv) providing instrumentation facilities free of cost. CORD would also like to arrange relevant lectures and seminars in the overall interest of the programmes, sometimes to bring together local scientists working on various aspects of the same problem.

### **CORD and its Social Purpose :**

Professor Rais Ahmad had suggested the following as CORD's social purpose : "CORD's sphere of work is such that it touches on both science and economic development-thus questions of technology feasibility, assessment and transfer, and of overall Government policies which may impact on whether a technology (or connected research need to be developed at all and if developed will be used at all - such questions cannot be avoided, and should therefore be properly brought under study. CORD should take initiative to create knowledge and opinion on such questions. The Seminar library of CORD should particularly collect books, magazines and papers on this area of relationship between science, society and policy and try to form a study group on these problems. Once a year when the General Body meets CORD in cooperation with Faculties of Science, Engineering, Medicine, should arrange for periodic review of work done. A mini science congress, with reports and papers, could be arranged every year-out of which the published annual report could be compiled. Evaluation of work, credit where due, and dissemination of it would be a very important responsibility to fulfill."

**Wahid U. Malik**  
Vice Chancellor



## Brief Review of Work

**Historical Development:** This is a new experiment in the University system for cooperative research coordinated at different levels but having a very definite objective, viz., solution of identified problems of development. The Centre is not a mere fund giving body, but it will share its resources in men and facilities, when necessary, with those collaborating with it in a given identified project. The Centre depends on funds on Agencies of the Central Government such as the U. G. C., C. S. I. R., I. C. A. R., I. C. M. R., D. S. T., D. A. E., etc. and the State Government.

A word about cooperative research is perhaps needed. It is often assumed that grant of a research scheme, or sanction of a fellowship by an Agency is cooperation. In a limited sense, it is. Without these, much of the research being done in Universities will come to a stop. The Centre seeks, especially from the technical Directorates and Departments of the State Government, both cooperation and collaboration with deeper involvement of the scientists of the two in the study and investigation of an identified problem. The University has in its various faculties expertise in different disciplines which the Centre can call upon in the solution of a given problem, or use the specialized knowledge and equipment available in other Agency laboratories in and outside the State of J & K, while the technical Directorates of the State Government perhaps have considerable back-ground information and survey data on a given development problem. To effectively share each others knowledge it is necessary that the Centre and the relevant State Department Scientists collaborate deeply by building suitable machinery to bring this about. The Centre is not set up to compete with the organs of the State Government but rather to collaborate with them in finding viable solutions to various problems. One should not look at these problems from the point of

view "who gets the credit"; but rather we should feel happy that we have helped in finding an appropriate solution.

Early in April 1979, in response to the proposal made by the University, the U. G. C. sent an expert committee which recommended that a Professor, 4 Readers, nine technical assistants and four Junior Research fellows may be appointed and that the university may put its efforts on the following broad areas.

1. Agriculture and agro-based industries including sericulture, horticulture, fruit preservation etc.
2. Resource Management and Resource Utilization including fisheries animal husbandary, dairing, poultry, sheep farming etc.
3. Environmental problems with a high priority to biochemical and micro-biological work related to the protection of the environment, air, land, human habitat and water resources including drinking water.
4. Forest resources - including their management and judicious utilization, biodegradation of organic matter and bio-utilization of energy.

The U. G. C. accepted the recommendations and issued the sanction in June, 1979. During that year one hut (No. 52) was renovated for use as a laboratory and another new one measuring 4000 sq. ft. constructed near it in the Naseem-Bagh campus. This has now been commissioned. Due to paucity of funds a few important items like fume hoods and glove boxes for the tracer laboratory could not be obtained so far.

As a result of contacts built up with BARC, the University sent for training eight scientists from the University and the Regional Engineering College to BARC in December 1979 and in 1980 another similar number to carry out work for which facilities did not exist in the Centre. For example two scientists went for tissue cul-



ture work on mulberry, two for work in connection with apple scab and powdery mildews, two for training in radioisotopes in control of insect pests and two for use of advanced techniques used in analyses of lake sediments, aquatic plants etc. On tissue culture work there continues to be close collaboration between CORD and BARC scientists and it is hoped to establish this in other areas as well.

Early in 1980, three Readers joined the Centre and during the year most of the technical assistants. The Centre now has a Professor/Director, three Readers (the fourth is to join shortly), eight senior and junior technical assistants, three junior research fellows and a few research scholars. During the short time that the staff has been in position considerable amount of work has been done, a summary of which is given below :

The Commission for Alternative Sources of Energy (CASE) under the Department of Science and Technology has sanctioned a project, "Survey for Renewable Resources of Energy and Energy Needs in Jammu and Kashmir State," which is being operated under Professor Jagdish Shankar. Projects on "Impact of Human Settlements on Ecology of Rural Lakes of Kashmir" and another on "Man made entrophication of Kashmir Laks" sanctioned by the Department of environment and the U. G. C. respectively are being operated under Dr. D. P. Zutshi, Reader in CORD.

### **Environmental Studies :**

On problems of environment considerable work has been done on several water bodies of the region including the Dal Lake, and some high altitude lakes by Dr. Zutshi and his collaborators. In this work assistance has been received earlier in the form of use of laboratories from S. P. College since our own were not ready. Besides, the scientists of the Regional Engineering College, Srinagar are collaborating in the study of Dal Lake waters and have undertaken de-

termination of heavy metal ions with help from NRL-BARC. On the basis of investigations carried out during the last two years and the data collected on Dal Lake in open waters and those near large populations, it is concluded that the water in the latter areas are very heavily polluted inspite of progress in Dal Development Project. The situation is not likely to alter as long as raw sewage from house boats from the populated city areas is allowed to run into the lake.

### **Apple Scab and Mildews :**

Horticulture had been identified as an important area of study because the state derives considerable economic benefits from this source. Apple scab is a fungus infection which is proving to be a menace to the apple industry in this State as well as elsewhere. Dr. A. M. Shah and his collaborators have undertaken a study of epidemiology and control of two infections, the scab and the powdery mildews. The group has evolved a warning technique on the basis which orchardists can be advised of the correct timing of the first and subsequent spray. In field trials, the regimes evolved have shown excellent results inhibiting the infection to better than 90%.

### **Tissue Culture**

The silk industry needed not only better quality silk worms but also good quality mulberry trees which provide the food for the worms. One of the methods of multiplying plants and trees true to the parent is through plant tissue culture. In collaboration with BARC considerable success has been achieved with mulberry, from the callus to plant in the ground, with leaves and roots. Tissue culture is now being tried on pinus species.

### **Entomology Studies :**

Forests are this State's wealth and the Government derives



large revenue from forestry. Trees and forests are fast disappearing mainly due to large scale felling of trees. The other menace is the various insect pests. Dr. Rishi and the entomology group here have started a survey of these pests and their biological control. Since the Nuclear Research Laboratory (BARC) has now moved to Zakura, just 2 km from University campus, many more collaborative programmes can be undertaken, such as for control of pests.

### **Energy Sources :**

At the suggestion of the Board, a status report of present knowledge on solar energy had been prepared by a team of University and N R L Scientists about a year ago. The Commission for Additional Sources of Energy (CASE) under the Department of Science and Technology of the Government of India has now asked CORD to undertake a survey of "Renewable Energy Resources and Energy Needs in Jammu and Kashmir". The actual collection of data has just been completed in all the three regions (Jammu, Kashmir and Ladakh). The Data are being analysed and the report is expected to be ready by the end of this year.

### **Chemistry of Medicinal Plants :**

Some work has been started on chemistry of medicinal plants of the valley. Facilities have been organised for plant extraction, chromatographic separations and some spectroscopic analytical work. This work is now being systemised.

### **Problems for the Future :**

With the use of many modern techniques and knowledge apple production in the state has significantly increased. To get the best returns, the apple has to be exported within and out of the State. This brings up the question of packaging. Already our timber resources are dwindling fast and costs of wooden crates has risen sharply. Work needs to be undertaken on alternative packaging ma-

terials, such as on some fibrepolymer combination, to produce reusable packaging.

Many years ago considerable work had been done in BARC, Bombay on wood-polymer products. This process converts very ordinary soft woods, such as those used in packing cases, into hard strong materials. All the know-how is now available in NRL-BARC Srinagar. Excellent wood carving, for which Kashmir is famous, can be done on this material. This process should be exploited here. Wooden handles for modern cutlery can be made from such wood-polymer products and this can find even an export market. A third use is to produce wood-polymer products, with different dyes and fragrance, which can be employed for handicrafts to attract tourists. Thus we can use some of the poor grades of timber to earn larger economic benefits for the State.

### **Ladakh ;**

Mention may also be made of the immense possibilities of development, through application of science and technology, that exist in the largely unexplored Ladakh region. To be able to achieve anything worthwhile, establishment of an extension centre is essential. A small team of scientists should be stationed in Ladakh (say in Leh) for 5-6 months in a year to carry out wide ranging surveys and experiments, on utilization of solar energy and on ways of providing better and more food for animals and man.

In the subsequent pages is given a brief account of work done on different projects undertaken in the Centre during the past two years.

*Director*

## STAFF

### Faculty

1. Professor M. Y. Qadri	Director
2. Dr. A. M. Shah	Reader
3. Dr. N. D. Rishi	Reader
4. Dr. D. P. Zutshi	Reader
5. Dr. B. A. Subla	Officer on special duty

### Technical

Mr. A. M. Paray	:	
Dr. Ashwani Wanganeo	:	
Dr. Ashok Pandit	:	STA
Mr. G. N. Qasba	:	
Mr. Khursheed Ahmad	:	
Mr. Ghulam R. Sheikh	:	
Miss Bilquis Qadri	:	JTA
Mrs. Sarojni Handoo	:	
Mr. Anil Dhar	:	
Miss Nirja Wali	:	
Miss Beena Bakshi	:	JRF
Mr. Mushtaq Ahmad Lone	:	

### 1. Energy Project

Mr. Ravinder Saraf	Engineer
Mr. Zahoor Bhat	:
Mr. Manzoor Shorie	:
Miss Nusrat Javedani	:
	TA

## 2. MAB Project

Miss Rajni Raina	SRF
Mr. Abdul Qayocm	SRF
Mr. Irshad Ahmad	JRF
Mr. Vir Krishen Koul	JRF

## 3. UGC Prcject

Miss Anjali Koul	:	JRF
Mr. Abdul Rashid Bhat	:	JRF

## Research Scholars

Mr. Reyaz Ahmad Kangoo  
Mr. G. M. Mir

## Teacher Candidates (for M. Phil)

Mrs. Ashmat Mahdi	Mr. Ahmad Ullah Khan
Mrs. Salma Fayaz	Mr. N. A. Mufti
Mr. Abdul Rashid Wani	Mr. G. S. Survar
	Mr. Bashir Ahmad Wani

## Other Staff

Miss Javeeda Akhtar	
Mr. Abdul Ahad Sofi	
Mr. Ghulam Hassan Sheikh	
Mr. Mohd. Ayub Sofi	
Mr. Ghulam Rasool Parra	Field Assistant
Mr. Mohd. Shafi Bhat	Field Assistant



## Review of work done in CORD June 1980-June-1982.

### 1. Plant Pathology

Kashmir is one of the chief producers of rosaceous fruits in India, the home of a special variety of world famous silk and a great repository of forest wealth, yet it is an area where research and developmental technology in preservation of these special characteristics has remained neglected in the past.

Despite the productivity potential and the socio-economic importance of the apple industry and the cultivation being carried out on a large scale, no realistic cognisance has been taken of the damage posed by scab, powdery mildew, fruit rots and leaf spot diseases. Continued neglect is harming the future of the fruit industry, especially the cultivars of apples, in this State.

Application of various techniques to determine how early infection of the host tissue can be ascertained in advance, will open up new avenues for obtaining a break through in disease control. Keeping in view this possibility various projects are under study. However, immediate attention to two priority areas is being devoted viz. apple scab and apple powdery mildew diseases.

#### THE APPLE SCAB (Participants : G. N. Qasba and A. M. Shah)

The programme on this rampant plant disease is mainly concentrated on epidemiology and control.

Screening for scab in orchards of all the six districts of the valley was started in June 1980 to determine prevalence, distribution and severity of the scab. It is found that severity of the disease varies in different agro-climatic regions, and environment plays a significant role in this. The strategies that could be adopted for con-

trol in the different regions of the valley are given below. The detailed recommendations are given elsewhere.

### 1. Environment and Development of Perithecia (fruiting body)

A series of experiments were conducted in 1980 and 1981 to understand the role of rainfall and temperature in perithecial development and maturity. In 1980 the perithecial initials were visible after Feb. 2 and ascospores were ready for discharge on April 4. In 1981 the perithecial initials were visible after Feb. 12 and mature ascospores were ready for discharge after March 27 (Meteorological information chart of 1980-81.)

#### Meteorological information chart of 1980 - 81

<i>Year</i>	<i>Month</i>	<i>Mean Minimum temperature</i>	<i>Mean Max. Temperature</i>	<i>Total Rainfall</i>
1980	February	0.4°C	7.4°C	133.6 mm
	March	4.3°C	13.7°C	71.6 mm
	April	8.5°C	22.9°C	36.2 mm
1981	February	1.1°C	8.8°C	90.9 mm
	March	3.9°C	13.3°C	207.7 mm
	April	8.2°C	21.5°C	68.0 mm

During both the years the ascospore discharge was monitored with the help of spore traps designed and fabricated in the laboratory. From these observations it is concluded that there is no clearcut relationship between tree development and fungus phenology.

### 2. Forecasting of apple scab

It is well known that prediction of the time for development and severity of a disease for the employment of efficient control measures, is the result of interaction between environment, pathogen and the host.



The experiments and environmental studies provide definite information whether development of a fungus is complete or not, as there exists a diurnal pattern in perithecial maturity and ascospore discharge. It is therefore worthwhile to monitor first the perithecial maturity and ascospore discharge. After this, one can give definite warning to orchardists through commercial media about the correct timing for first spray. These studies can be supplemented with micro-exploration of apple scab infection, i. e. in laboratory it is possible to detect the initials of the pathogen before-hand by sampling apple leaves which have no visible infection. In nature it takes more than twenty days for symptoms to appear after germination of spores on the host plant.

Such predictions are designed to warn growers of the expected significant development in the plant disease picture; it can be compared to advance intelligence news of the movement of the enemy, and if sufficiently accurate, efficient control measures can be planned. We hope to provide know-how for this through our investigations.

### 3. Variability in apple scab pathogen

Studies conducted to explore possibilities of existence of various physiological lines in *Venturia inaequalis* (casual organism) have revealed the existence of three pathotypes in Kashmir Valley.

### 4. Chemical control of apple scab

Various strategies were evolved for observing the effect of different fungicides, urea and antibiotics on perithecial formation, ascospore production and leaf decomposition (post harvest sprays).

The following fungicides gave above 90% inhibition in ascospore production. Those were applied only in recommended dosage :

<i>Fungicide</i>		<i>% inhibition achieved</i>
Baycor	...	91.1
Ziron	...	93.5

RH-2161	...	...	90.3
Dithane M-45	...	...	97.1
Cuman - L	...	...	94.7
Difolatan	...	...	94.1
Delan	...	...	91.1

Application of urea and an antibiotic alone and in combination with other fungicides enhanced leaf decomposition :

Delan,  
Urea + Dithane M-45,  
Urea + Agrimycine,  
Bavistin + Cuman-L,  
Urea + Bavistin,  
Difolatan + Ziron,  
Urea.

There was appreciable reduction in perithecial formation\*

Consequent to the presentation of our convincing results at the panel discussion at the 3rd International Symposium at Delhi in December 1981, the Government of Jammu and Kashmir have released Dithane M-45 on subsidised rates to orchardists as the anti-scab fungicide although in 1981 no purchase of this fungicide was made by the Government. Earlier Dithane M-45 was taken as ineffective against apple scab by the local authorities. (G. N. Dar, B. L. Putoo and M. Y. Gani. Ineffectiveness of Dithane M-45 against *Venturia inaequalis* causing apple scab disease in Kashmir, 3rd Inter. symp. on Pl. Path., IARI New Delhi, 1981 pp 98 - 99).

The studies on resistance in *V. inaequalis* to various fungicides are in progress.

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\*G. N. Qasba and A. M. Shah. Effect of fungicides, Urea and antibiotic on perithecial formation and ascospore production in *Venturia inaequalis* (3rd International symposium on Plant Pathology, IARI, New Delhi pp 149, 1981)

## EVOLVEMENT OF NEW FUNGITOXIC CHEMICALS :

(Participants : G. N. Qasba,  
Anil Dhar and  
A. M. Shah

The State of Jammu and Kashmir is spending considerable sums on purchase of fungicides every year. It was therefore decided to screen various plant species (mostly locally available) for anti-scab activity. In this direction last year about 40 plant species were screened and the results of some are promising, especially with one herb available in plenty in the Valley (Code TA-1). Several active principles in this after isolation appear to be effective against the scab pathogen. Further work is in progress.

Another aspect of work is residue analysis of various pesticides. Two of the research workers of this Centre have received training at Biology and Agriculture Division of BARC, Bombay, in these techniques and it is proposed to initiate in this direction shortly in collaboration with BARC.

## LEAF SPOT DISEASES (Participants : Veena Kumari and A. M. Shah)

To have a direct bearing and relationship with apple scab, a project on leaf spot diseases of some important plants of Kashmir Valley is also in progress.

The leaf spots reduce the photosynthetic area of the plant and thus impair its food manufacturing capacity. Such diseases also involve production of toxins which cause injury to host cells. Leaf spot diseases outnumber all other plant diseases. Usually these result in destruction of cellular contents and collapse of cell walls.

So far encouraging results have been obtained on the effect of different soil nutrients (N, P, K,) when applied in different dosages,



both individually as well as in combinations, on one of the most susceptible and commercially important apple variety, the Red Delicious.

#### FRUIT ROT DISEASES

(Participants : *Farhat Jabbar and A. M. Shah*)

The cultivated resaceous fruits of Kashmir to be marketed have to be transported long distances from the centres of production. Wastage of the fruits during storage is very serious, and before reaching the market or consumer, various types of rots develop as incipient infection in the field or through contaminants during picking, harvesting, grading, packing, etc. Such rots reduce the market value of the produce. It is, therefore, desirable to protect the fruit from infection and spread of disease during transit and storage. This calls for a thorough investigation of the pathogens responsible for such rots. This is being done through identification of various pathogens and adoption of control measures. Two important apple varieties - the Red Delicious and the American are the source materials. So far a few fungi, now to Kashmir Valley have been isolated. Their cultural and other microscopical details have also been worked out.

Various fungicides like Captan, Dithone M-45 and Ankur at different dosages are being used in order to achieve control of such pathogens. The results obtained as far are promising.

#### POWDERY MILDEW OF APPLES :

(Participants : *Anil Dhar and A. M. Shah*)

The powdery mildew caused by *Podosphaera leucotricha* is next in rank to scab. The disease was reported in the valley nearly three decades ago, and yet it has attracted little attention as a potential threat to apple and other fruit crops. In view of its increasing incidence due attention is also being paid in CORD to its study since 1980.

### 1. Survey of powdery mildew disease on apple :

The various agro-climatic regions are being surveyed. The study is confined to the prevalence, severity and the distribution of the disease amongst the different apple varieties grown in the valley.

### 2. Variability in apple mildew pathogen :

Both morphological and physiological variability is being studied, the latter in laboratory as well as in field by cross inoculation techniques.

### 3. Environment and Disease Development :

Like apple scab here also the host-pathogen interaction is affected by prevailing environmental conditions. The data compiled so far is to be correlated with the meteorological data. Along with this effect of tree phenology on the development of the disease and the seasonal carryover of the pathogen is in progress.

### 4. Control of apple mildew :

The final goal of these studies is to achieve control on powdery mildew causing fungi. Of the many directions tried the testing of antispore activity by different fungicides have been used both in the field and in the laboratory. Post harvest and on season sprays are being carried out so as to determine the efficacy of different fungicides and to know the exact timing for recommending sprays. Also the studies of curative and preventive efficacy of different fungicides is at hand.

The following fungicides at various recommended dosages have been tried in different series of experiments for control of apple powdery mildew : \*

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\*Anil Dhar and A. M. Shah 1981. 3rd International Symposium IARI, New Delhi. pp 149 - 150.

Bavistin : Callixin : Topsin Baylton : Baycor :  
 Dithane M - 45 : Cuman - L : Sapprol : Hoxacap : Delan :  
 Feltaf : Karathane and RH - 2161.

Along with these some sticking agents have also been tried.  
 This year the trials are being repeated.

Further investigations have shown that :

- i) amongst commercially important varieties Ambri is most susceptible ;
- ii) Rainless days but humid atmosphere favour the development of the disease :
- iii) the on-season sprays coupled with mechanical pruning of diseased twigs help in checking the disease to a great extent
- iv) use of stickers with fungicides helps mildew control : and
- v) systemic fungicides under trial may prove efficaceous.

LEAF CURL DISEASE OF STONE FRUITS : (Participants ;  
*Asmat Mahdi and*  
*A. M. Shah )*

The commercially important stone fruits of the valley, peach, almond, cherry, plum, apricot, etc., are equally prone to plant diseases, the common one being the leaf curl, caused by a fungus **Tophrina deformans**. Since November 1981, work on application of different fungicides on the diseased tree, tree phenology, appearance of disease symptoms and cultural aspects are in progress  
 Concluding remarks :

(a) the conservation and the maintenance of germplasm of wild species for root-stock value together with old cultivars and genetic stocks ;



(b) advise the orchardists about the use of adequate and most effective fungicides and seasonal spray schedules;

(c) organize apple and other fruit shows for maintaining standards.

(d) assist the orchardist by trained personnel

(e) Recommend effective legislation

There is urgent need for technico-economic survey of apple trade in Kashmir valley at the State level in collaboration with the Centre of Research for Development, Kashmir University to find out the problems facing this industry.

## II. Tissue and Organ Culture.

The use of cell and tissue culture has come to be recognised as a new avenue for plant propagation. The success in asexual propagation **in-vitro** of many herbaceous flowering plants including monocotyledons has been achieved.

The plant cell and organ cultures have several applications of great economic value like clonal multiplication, establishment of disease free stocks, protoplast culture, somatic hybridization, etc. Realizing this, two of the many pressing problems in the State were recognised, viz, regeneration of (a) mulberry-essential for the silk industry, and (b) forest trees particularly the conifers.

**REGENERATION OF MULBERRY:** (Participants : Axra N. Kamili,  
A. M. Shah & P. S. Rao.

Mulberry, a fruit bearing tree, is under cultivation since long in Kashmir and many other parts of the country, chiefly for sericulture. The leaves constitute the chief food for silk worm (**Bombayx mori. L.**)

The bark of tree is used for manufacture of paper and the heartwood for making sports items,

The slow propagation of mulberry plants has retarded further development of silk industry. Thus, **in-vitro** studies on mulberry were taken up with following main objectives :

1. use tissue and organ culture for rapid multiplication of mulberry.
2. investigate the possibility of using callus tissue developed from leaves as food for silkworms ;
3. make leaves available as far as possible in required quantity and quality
4. to break dormancy in the plant
5. obtain specific pathogen free mulberry plants.

The availability of a large number of genotypes further appears to call for tissue culture approach to raise the desirable mulberry.

The experiments conducted since 1980 on various species and varieties are summarized below. These involve studies on :

- i) morphogenetic response on various growth regulators and natural extracts on leaf discs, stems and petiole explants.
- ii) effect of various growth hormones on axillary buds ; and
- iii) assessment of the effect of various growth regulators on breaking of dormancy in mulberry.

It has been observed that various hormonal and natural extract treatments strongly influence callus formation from stem and petiole explants. Leaf discs show moderate callus formation in presence of growth hormones. Petiole explants are responsive and produce prolific callus.

The axillary buds when cultured in solid media from robust



plantlets. Basal portion de-differentiated into callus mass. Along with plantlet and callus formation from the explant nearly 40% cultures have regeneration of inflorescence (mainly female flowers). Fruit formation was observed when auxins were added.

REGENERATION OF CONIFERS (Participants : *Usha Tikoo, Salma Fayaz and A. M. Shah*)

It is desirable to reforest with trees having superior genotypes, that grow faster, longer, straighter, are responsive to silvicultural practices and are resistant to diseases and pests.

The method of breeding adopted successfully for many agricultural crops, will not prove successful in conifers due to long life cycle which makes obtaining of superior varieties a lengthy process.

Another way to reforest with superior genotype is to take advantage of variations in the natural populations and vegetatively propagate superior specimens. Next problem is that cuttings may grow slower than seedlings (i. e. pinus). In an attempt to bypass some of these problems formulation of programme on the tissue culture of the commercial conifers like **Pinus, Cedrus, Picea** and **Abies** has been undertaken.

The following programme has been envisaged ; work on some aspects has already been completed.

i) collection of seeds and young seedlings of various species from different parts of the valley has been completed. Young seedlings from various forest nurseries were transplanted in botanical garden ;

ii) tissue culture techniques on explant segments and needles have been applied and the work is in progress;

The nutrient medium contained 2% sucrose. Addition of hormones cytokinins, auxins etc (different concentrations) and their effect on the source material is being studied to induce callus for-

mation on the mature explant segments ;

iii) to initiate and establish tissue and organ cultures from seedling tissues as well as from mature trees ;

iv) to study the parameters from successful regeneration of whole plants in culture tissues and organs ; and

v) to investigate and establish conditions for transfer of *in-vitro* plants to soil.

### **Review of Energy Research in cord**

The energy survey work stated with preparation state of art (and science) report on solar energy utilization by

Dr. D. S. Parmar Reader in Physics, Univ of Kashmir-(Convenor)

Mr. M. S. Qureshi, Nuclear Research Laboratory, Srinagar.

Mr. G. M. Wani, Nuclear Research Laboratory, Srinagar.

The report covered three main aspects

- (i) Photovoltaic conversion      (ii) Photothermal conversion
- (iii) Photochemical conversion and energy storage

and dealt in detail with the feasibility of solar energy utilization in J&K State with special emphasis on its potential in Ladakh region where solar energy is available in abundance throughout the year. Realizing the importance of renewable energy studies in Ladakh, CORD made an on-the-spot preliminary survey under the leadership of Professor J. Shankar, Visiting Professor and then Director CORD in July/Aug. 1980 for ten days. Apart from the study of many other aspects like the water chemistry, plankton population, soils, herbal plants etc; the potential of renewable energy availability and prospects of its utilization were studied. Based on the measurements of solar radiation, sun shine hours, wind velocities etc., the energy scene in Ladakh was found to have the following specific features that

arise from the region's geographical location, and socio-economic structure.

### 1. Solar Energy :

Solar energy in Ladakh is by far the most attractive alternative energy source as it is available all over the region in quantities of 150-250 Kwh/m<sup>2</sup> per month. This is a highly significant amount for photovoltaic or/and photothermal applications. However, the spectral construction of the solar energy, a very important aspect for any research activity in the area, could not be determined for lack of scientific equipment for the purpose in Ladakh.

### 2. Wind Energy ;

The wind power has a fundamental advantage over traditional solar power in that the wind energy being available in mechanical form could be easily converted into shaft power without involving any other conversion cycle for applications like water pumping, water lifting, electricity generation, etc. In Ladakh, considerable amount of wind energy is available in certain areas near Leh where wind velocities of 200-300 knots/hr have been experienced. Although efforts were made in 1968 by the local administration to utilize this potential it failed probably due to inadequate design of the wind mill and lack of technical manpower for maintenance of the machine. However, wind energy potential exists in areas around Leh which needs to be explored by changing the wind mills design and making it more modern and suitable for the purpose.

### 3. Hydraulic Energy :

The energy from flowing waters is another area which needs to be explored in the region. The potential is quite high around Leh and Kargil for the hydroelectric generation, using mini and micro units.



#### 4. Bio—mass:

Wood has been the traditional energy source for the local population in Ladakh. This has led to considerable deforestation in the region. The afforestation with fast growing trees suitable for that region is another possibility to meet the energy demands of the local population. There exists a tremendous potential in this area for collaboration with the forest department. Because of lack of irrigation facility, identification and plantation of fast growing trees which could be grown without or with very little irrigation is an urgent necessity.

It was concluded on the basis of preliminary energy studies that the whole J&K State is one of the richest in renewable energies and there exists a tremendous potential for energy research both because renewable energy sources are available in plenty, and also because of demand for alternate energy for the local population. It was therefore decided to fully understand and explore the locally available energy sources in the state in order that the local population may make the best use of it and thus reshape their economies and energy consumption practices. A project on "Survey of Renewable Energy Resources and Requirements in J&K State" has been sanctioned by the Commission on Alternate Sources of Energy, Department of Science and Technology, Govt. of India, in September 1981, with Professor Jagdish Shankar as its Chief Coordinator. The aim of the project is to study and assess the actual state of renewable energy resources and energy requirements in J&K State with a view that whatever renewable energy technology is adopted, it is adequate, technically and economically sound, culturally acceptable and responds to a real need within the community. In order that the renewable sources of energy become successful as an element in the over all development process of the J&K State, the project envisages.

- (i) assessment of the present and future energy demands

(ii) assessment of the energy consumption patterns of the populations.

(iii) assessment of the area-wise renewable energy potential in terms of its suitability for different applications.

(iv) knowing the energy demand and its availability in a particular area, to make a comprehensive classification of the demand according to type of energy required.

(v) To establish relationship between energy demand and renewable energy availability. It can then be determined which energy technologies not only have the greatest potential to succeed but which can satisfy the greatest demand.

(vi) assessment of where and how the renewable energies are currently being utilized in the State.

(vii) assessment of how renewable energies applications can improve the economy of the population.

(viii) assessment of how the current energy utilization habits can be improved for better efficiency and what utilization habits should be encouraged for the future.

Questionnaires for the sample survey of house-hold schedules and village schedules were prepared and submitted to DST for their approval alongwith the project.

Soon after the project was sanctioned the Vice-Chancellor, constituted a working group consisting of the following ;

Professor Jagdish Shankar, Director, CORD	—Chief Coordinator
Dr. D. S. Parmar, Reader in Physics	—Coordinator
Professor A Wahid (Department of Economics)	—Member
Dr. Majid Hussain (Department of Geography)	—Member
Mr. Nisar Ali Department of Economics)	—Member

In view of the unavailability of census survey reports, 1981, the survey was conducted on the basis of 1971 census survey reports with appropriate sample size to give significant results. All Districts and Tehsils were covered under the survey. Further, 7% of the villages in each Tehsil and 7% of the households in these sample villages were surveyed. Calculations showed that the number of villages to be surveyed would be around 500 and total households around 4000.

The actual field survey was commenced in Nov. 1981 after the initial training to the nine investigators put on the survey work, including the four appointed for the project.

With the appointment of a mechanical engineer in Dec. 1981, the survey work acquired more dimensions as proposed. The whole survey work was divided into two parts (i) field survey for determining the energy consumption patterns of the local population, and (ii) assessment of the renewable energy availability, potential of its being used for different applications and present energy consumption scales in the State. The latter part included the assessment of already tapped, planned for tapping in future 5, 10, 15 years and completely untapped resources of energy in renewable form. This required the collection of information and data from various Central Govt., State Govt., semi-govt. Departments and even private organisations. The whole survey team shifted to Jammu in Jan. 1982 to launch the above mentioned two aspects of the survey under the overall supervision of Dr. D. S. Parmer, Reader in Physics and Coordinator of the project.

The survey work in the Jammu and Kashmir regions was completed by June 15, 1982 and in Ladakh by end of July. The task of collection of data and information concerning the project from various Departments has been completed to a considerable extent. Analysis of data is now in progress. The data analysis and preparation



of the report is expected to be completed by the end of the year.

The report on the project will contain comprehensive classification of both the Genotypes (the renewable energy resources which can easily be used for appropriate applications at scaled levels within a given region, the determining factor being an overall use of the same energies within an acceptable range) and Phenotypes (the modification of these regional energy sources on a local or district level to suit any site within that area) of renewable energy resources and potentials of their utilization. The report will also give directions towards the future consumption strategies which need to be planned by the local population for self support and modifications in their eating and living habits to make capital by reducing on fuel consumption keeping in view the historical, cultural and social aspects.

On the basis of the research findings of the project, CORD proposes to schedule a few demonstration projects to illustrate the potential of renewables energies within a given area. Several demonstration projects are proposed, one in each region (namely Jammu, Kashmir and Ladakh) of the State with total investment from the Department of Science and Technology. The task of site selection is also being looked into simultaneously with the survey work.

#### Survey Team :

Professor Jagdish Shankar	
Dr. D. S. Parmar, Reader	
Dr. Ashwani Wanganeo,	S. T. A, CORD
Dr. Ashok Pandit,	S. T. A, CORD
Shri Ghulam Rasool Sheikh	J. T. A, CORD
Mrs Sarojni Handoo,	J. T. A, CORD
Miss Bilquis Qadri,	J. T. A, CORD
Mr. Manzoor Ahmad Zargar,	L. A, CORD
Mr. R. K. Saraf, B. E.	
Mr. Zahoor Ahmad Bhat,	Tech. Asstt.
Mr. Manzoor Ahmad Shori,	Tech. Asstt.
Miss Nusrat Javidani,	Tech. Asstt.

## **Environmental Studies**

1. Monitoring and Surveillance of the Dal Lake Environment with reference to Pollution (D. P. Zutshi, A. Wanganeo, Rajni Raina, A. U. Khan, N. A. Mufti and Reyaz Ahmad Kango).

Dal Lake is regarded as one of the most beautiful spots in the world. Its open water area (11.15 Km<sup>2</sup>), imposing mountain amphitheater which surrounds the lake on three sides and the charming Moghul Gardens and orchards around it attract tourists from all over the world. During the last few years grave concern is being voiced over the deteriorating conditions of the lake environment. There is no denying the fact that the Dal Lake has fallen victim to human greed as a result of which this water body is under great stress. The water quality of the ecosystem has deteriorated considerably coupled with excessive growth of aquatic weeds and siltation. Large areas of open water have been reclaimed and used for construction of hotels, restaurants and houses and for growing vegetables etc.

Alarmed at the rate at which the Dal lake is shrinking the State Government with the help of the Commonwealth Fund for Technical Cooperation invited Enx of New Zealand Inc., a consultancy team, reported on the pollution status of the Dal lake. The State Government accepted these recommendations with some modifications. The work on the Dal Development Project is in Progress for more than two years now. Since there is no agency to monitor the pollution levels of the lake vis-a-vis the progress of the project, it was thought worthwhile to take up the surveillance of the environment and monitor the restoration from April, 1980 and till March 1982. During the first year of this study twelve sampling sites distributed within the inshore and offshore area were surveyed. The selection of the sites was such that equal representation was given to areas close to human settlements, houseboats, hotels and to open water areas. In the subsequent year additional nineteen sites were added taking the overall total



to thirty one. Some of the sites were exclusively used for measuring phytoplankton photosynthesis and others for evaluating phosphorus dynamics. The parameters investigated were water clarity, temperature gradient, dissolved oxygen, BOD, COD, pH, hardness major cations and anions, P and N. Enumeration of plankton population was done both qualitatively and quantitatively. Primary production was measured using C-14 isotope. The data are being processed but some preliminary trends are reported here:

(1) Within the human settlements and houseboat areas receiving high concentration of untreated sewage and other waste material, the extent of pollution differs depending upon the water renewal period, and the flow pattern. The entire inshore area of the lake cannot be grouped into one trophic level. The pollution gradient differs significantly. This is supported by the levels of nutrient concentration, density and nature of plankton population and microbial activity. These areas are in need of immediate curative measures. The open water area of the Dal lake is still in good condition and every care should be taken to protect it from any degradation.

The polluted Dal lake waters show low water transparency, low pH, high specific conductivity, low D. O, high BOD and higher difference between the winter and summer alkalinity. It has been observed that the general trend in inshore area is the progressive increase of phosphorus content through the last few years. This is quite significant when one considers the importance of phosphorus in the problem of eutrophication.

High numerical density of some plankton classes in inshore areas, e. g., Cyanophyceas and Euglenophyceas, in comparison to open water areas is also suggestive of high pollution levels. Some biological indicator species have been identified at the polluted sites which seem to be quite useful for evaluation of eutrophication gradient. The daily and annual phytoplankton production is almost three times in Hazratbal than that in Nageen. This is a case which provides

evidence of increasing human pressure in the former basin.

On the basis of the preliminary observations it may be concluded that although work is in progress on the Dal Development Project there are no signs of improvement in the water quality or in the general environment of the lake. This study infact has shown that the polluted areas are getting more polluted and open water areas have increased concentration of suspended matter as a result of erosion from the newly laid bunds and roads. There is need for future continued monitoring of the lake and also for the Government agencies to adopt measures to improve the quality of this beautiful lake.

## **2. Impact of human settlements on the ecology of rural lakes of Kashmir**

(D. P. Zutshi, B. A. Subla, Rajni Raina, Abdul Qayoom, Irshad A. Wani and Vir K. Kaul)

This project sanctioned under the Man and Biosphere Programme of the Department of Environment, Government of India, started from September, 1981. The aim of the project is to assess the impact human activities in the catchment of the lakes and its relationship with the process of eutrophication. The data are being obtained on the trophic status of three lakes from the Ganderbal and Sonawari Tehsils. Investigations are in progress on the impact of drainage pattern on the extent of pollution, stress tolerance of the ecosystem, structure and functioning of the biotic communities, and development of a model for predicting the extent of ecosystem imbalance and the restoration measures.

## **3. Survey of High mountain lakes : (D. P. Zutshi, A Wanganeo and H. S. Raina**

During summers of 1980-81 an ecological survey of three high altitude lakes from Sonamarg and Pahalgam areas was undertaken to obtain data on watershed features, physical factors, water chemistry, plankton life and phytoplankton photoyntesis. The lakes are oligotrophic



with low nutrient concentration in their waters. Geomorphology of the watershed coupled with negligible human impact is responsible for low trophic level. The levels of phosphorus and nitrogen remain low in the lake waters and the same is the case with primary production. Plankton population has high diversity but low numerical representation. The lakes harbouring trout fish have high population of aquatic insects. The growth and survival of brown trout in some of these high altitude lakes is presumably due to ideal food-web and favourable spawning area.

It is proposed to extend this study to other high altitude lakes in order to have base-line information on general environment for management and development of trout fishery.

#### **4. Ecology of polluted and non-polluted areas of the Anchar lake (D. P. Zutshi and A. U. Khan)**

A preliminary study on the Anchar lake has been carried out. The investigation has shown that the quality of water close to human settlements has deteriorated significantly over the years and these areas now harbour high biological population. The open water area has low turbidity and is moderately polluted. The high density of macrophytes is having a detrimental effect on the overall metabolism of the lake.

#### **5. Plankton Ecology, Macrophytic Vegetation and Nutrient Dynamics of Waskur and Ahansar Lakes: (D. P. Zutshi and M. Rashid-ud-Din Kundangar)**

The two lakes situated in the flood-plain of Jhelum river in the Sumbal area are being studied. The lake waters are moderately turbid. The water chemistry shows predominance of divalent cations. Phosphorus and nitrogen depict a definite seasonal cycle. The plankton have low species diversity. Primary production is high in summer as a result of rapid biological utilization. Human, animal and agricultu-



ral waste is mainly responsible for ecosystem imbalance. The two lakes are at two different trophic levels, Waskur being more polluted. The basic data would be useful for conservation measures that might be undertaken in near future.

6. **Man-made Eutrophication of Kashmir Lakes : (D. P. Zutshi, B. A. Subla, Abdul Rashid and Anjali Kaul)**

In this project recently sanctioned by the University Grants Commission it is proposed to work on Wular and Hokarsar lakes. The main thrust of this research would be to delimit the factors responsible for the cultural eutrophication. Rapid C 14 bioassay will be used as one of the tools in this investigation.

7. **Comparative ecology of Gilsar and Khusalsar lakes : (D. P. Zutshi and G. H. Wani)**

These two small lakes form an interconnecting system between the Dal and the Anchar lakes. The water from the Dal lake goes into the Anchar lake through Nalla Amir Khan canal, which receives high load of nutrients from the human settlements enroute. The present investigation has been initiated to monitor this nutrient input. The research when completed would help in preparing a nutrient budget for these ecosystems.

8. **Periphyton dynamics in Waskur Lake, Kashmir : (D. P. Zutshi, P. Kachroo and S. G. Sarwar)**

Periphyton community not only forms an important component of the primary production in lakes but is a good indicator of water pollution. Very little attention has so far been paid to periphyton community of Kashmir water bodies. The present project has been undertaken to investigate dynamics of periphyton on natural substrates. So far 63 genera have been recorded with diatoms constituting the bulk of the population. Presence of *Cocconeis placentula* with high numerical density is quite significant in view of its indicator value. Further studies are in progress.

## Chemical Investigations of Plants of Therapeutic interest

(Jagdish Shanker and Beena Bakshi)

The genus *Gentiana* (family Gentianaceae) comprises of about hundred twentyfive species distributed throughout the temperate regions of the World. The species of the genus are either annual or perennial herbs. In Kashmir valley *G. oliveri*, *G. kashmiriana* and *G. aurea* are found in temperate regions and the arid pleateau of Ladakh. The plants are locally used in the treatment of fever, headache, liver and lung ailments and are also believed to act as blood purifier.

Several species of *Gentiana* have been worked out from time to time for their chemical composition and varied types of chemical components like alkaloids, xanthones, steroids, terpenoids, lactones and favonoidalglycosides.

In view of the tremendous reputation the genus *Gentiana* had gained for its medicinal potentialities and the fact that the species *G. aurea* has escaped the hands of chemists till today, an attempt was made to work it out to have or idea about its chemical components.

The raw plant material was collected from Drass (altitude 10,750 ft. ), District Kargil (J & K) in the month of July / August 1980.

The chemical analysis has shown the presence of a number of constituents like xanthones, alkaloids, flavonoids glycosides and terpenoids. Out of these components, some could be important from chemotaxonomic and biogenetic point of view. Detailed work is in progress.

Some other plants like *Salvia moorcraftiana*, *Cirsium wallichii* and *Platanus orientalis* have also been taken up for detailed chemical investigations.

## Pathogenic Nematode Parasites of Sheep

(Prof. D. N. Fotedar, Nirja Wali)

Amongst various domestic animals, sheep harbour the largest number of parasitic worms causing many diseases, some of which are fatal to the host. Besides, helminth borne diseases, sheep suffer due to the infections of bacteria viruses and protezoans. The annual mortality rate among sheep in Kashmir due to various diseases is known to range from 25-50%. This may go up towards the outbreak of diseases in an epidemic form. The earlier census of sheep in 1966 shows decline in sheep population in the state.

The most common diseases among sheep in Kashmir are due to the liver-flukes, *Fasciola* and *Dicrocoelium*. The latter is an endemic infection and develops a serious pathological condition of liver. Schistosoma infection caused by the blood fluke *Orientobilharzia*, has been spreading more and more every year among sheep and cattle in Kashmir.

These parasites in their life cycle involve various species of snails as intermediate hosts. Besides therapeutic measures, feasible control measures taken, involve the control of the growth of snail population.

From among the nematode parasites pertaining to the Project, the bursate nematodes of the Strongylata group are the most serious pathogenic parasites. These are found in the gastro-intestinal tract of sheep and the diseases caused by them are widely spread in the state. The life cycle of these parasites does not involve any intermediate host. There is a free living cycle; the eggs pass out along with the faeces of the host, develop outside in favourable medium into various larval stages and ultimately the infective stage larvae find their way back into the gastro-intestinal tract of the host while grazing in pastures and other areas.



Studies so far are confined to the pathogenic gastro-intestinal nematode parasites as summarized below :-

1. Nodule worm : The common species of nodoler worm among sheep is identified as *Oesophagostomum (Proteracrum) columbianum*. It is found to cause nodular worm disease in the large intestine of sheep. Pathogenecity has been studied in detail. While the adult worm has been found to be practically non-pathogenic, it is the infective stage larvae which attack the mucosa of the large intestine causing diarrhoea and in chronic cases may even cause the death of young sheep. The larvae reach deeper in the submucosa; they encyst and undergo moulting to develop into the fourth-stage larvae. The larvae normally come back into the lumen of the intestine, but on reentering the submucosa develop local tissue sensitivity and initiate acute tissue reaction. The lesions so developed form nodules, as found in the present studies. The present histopathological studies show that the encystment is mostly on the deeper side of the muscularis mucosae in the submucosa, necrosis around effected foci, hyaline degeneration of submucosa, infiltration of eosinophils and fibreblasts. Mucinous degeneration was also found in the sections of the nodules cut for examination. Multiple nodules were found in the large intestine in large number of sheep material collected for examination. In many cases the lumen of the intestine was found obliterated due to the nodules.

Development of the eggs and larvae under local conditions in free living state was also studied. The larvae were successfully cultivated *in vitro* upto the III-stage (infective stage), under different environmental conditions. The optimum temperature range of 28-30°C has been found satisfactory for their development.

2. Another common strongylid pathogenic bursate nematode in sheep was identified as *Chabertia himalayana*. Besides detailed morphology of the parasite, the development of the juvenile stages in

*vitro* upto the III (stage larva-infective stage) were studied, which was found to be infective to sheep.

3. **Bunostomum trigonocephalum** has been identified as the common hookworm of sheep in Kashmir. Being blood - suckers, they cause anaemic conditions among sheep and are found to be localized in small intestine.

4. Among the Trichostrongylid nematodes in sheep, **Trichostrongylus colubriformis** and **Ostertagia (Ostortagia) circumcincta** have been identified. Both these bursate nematodes are pathogenic. More than the adult, it is their infective-stage larvae which at their initial stages of entry into the host per se cause the damage in the mucous membrane of the alimentary tract, where they develop further before their entry back into the lumen as adults.

**Ostertagia (Ostertagia) circumcincta** is recorded here for the first time from local sheep in Kashmir. Detailed morphological studies in this have therefore been made. Development of the larval stages and post-infective stage larvae of the parasite are in progress to understand the development and infection under local conditions.

5. **Trichocephalus skrjabini** is found to be most common "whip worm" in sheep in Kashmir, localized in the caecum and large intestine of the host.

This species has been found to be pathogenic, although not serious in case of light infection. The anterior narrow end was found in many cases penetrated into the mucous membrane of the caecum and large number of haemorrhagic foci located in case of heavy infections.

A rare infection of another species with morphological features, distinct from other known species of the genus has been recorded. It has been named as **Trichocephalus** sp. Further survey is in pro-

gress to determine the incidence and intensity of infection of this species.

Another group of pathogenic nematode parasites common among sheep are the lung worms which include **Di tyocanlus**, **Protostrongylus**, **Muellerius**. Out of these, life cycle of the latter two worms is known to be indirect, involving a snail or slug host. It is proposed to work out the life cycle of these parasites, identify the molluscan host in which the larvae grow, and find ways and means of cultivating larvae in the laboratory.

These studies will be helpful in devising measures to control their infection among sheep in Kashmir.



## **Monitoring insect pests by Biological techniques**

(N. D. Rishi & K. A. Shah,)

Entomological research is being oriented towards development of ecologically sound and environmentally acceptable biological techniques, so that chemical pesticides used for the control of the potential insect pest affecting agricultural, horticultural and forest resources of the State are minimized and the environment of the valley is freed from the increased pesticidal contamination. Existing biotic agents of natural control of these pests, (parasites, predators and entomopathogens (virus)] are being explored and techniques are being developed for their mass scale multiplication to use them as biological insecticides in the future programmes of crop protection.

Experimentation with these techniques on the Indian Gypsy moth *Lymentria obfuscata*, a severe pest of forest and horticulture in the State and Himachal, has shown the existence of a wide spectrum of such natural biotic agents of control, having promising potential to built such bio-control strategy under Kashmir agro-ecosystem.

Bio-chemicals (Pheromones) and nuclear techniques <sup>60</sup>Co irradiation) are being employed to have accurate information on population dynamics and behaviour of the pest. Forecasting and monitoring systems are being devised for pest outbreaks and to predict the time and need of application of selective pesticides so as to avoid their indiscriminate use.

## **Biological Studies on soil Mesofauna of Agricultural and submontane lands of Kashmir Valley.**

(N. D. Rishi & G. M. Mir).

Soil inhabiting mesofauna participate in decomposition of soil organic matter and remineralize the plant nutrients to influence the

physiochemical character of the soil in terms of its fertility. But the structure and composition, community function and feeding habits of the fauna is poorly known. Especially in the forest economy, the fauna is rich and varied. It associates with litter break-down to play an important role of disposal of biodegradable products as primary producers, to support an array of primary consumers in the food chain webdynamics.

Work has been initiated to have systematic and ecological exploration of this fauna. Soil samples from representative agricultural fields and submountain areas have been collected and processed for faunal extraction through various standard techniques. A good number of soil inhabiting mites, collemboles, microarthropodes, annelids etc were determined. Their qualitative and quantitative composition and impact assesment with regard to community function and feeding biology on broader ecological basis of the fauna will lead to better understanding of the role the fauna play in forest economy.

### **Survey and studies on the biology of aquatic insects of Dal-Lake in relation to fish productivity.**

*(N. D. Rishi & B. A. Wani)*

Aquatic insects constitute a major diet of fish, water fowls and migratory birds in the biotic environment of the valley. These establish a complex process of inter-relationship in the food chain web, with these water animals and the mesophytic vegetation to cause organic productivity of the water bodies.

Therefore a study of their population dynamics in the water bodies will lead to determination of the ecological role they play in the food chain web as herbivores, decomposers and scavengers in the aquatic ecosystem. A survey conducted during 1981 has indicated a fair number of aquatic insect species in the Dal-Lake some of which constitute major dietary components to sustain the endemic fish. The biology, seasonal dynamics and their inter-relation with the fish and impact of ecological factors on the fauna are being studied.



## **SURVEY AND STUDIES ON THE BIOLOGY OF LEAF-MINING INSECT PESTS of some economic plants with reference to Biological Control.**

( *N. D. Rishi & A. R. Bhat* )

Leaf-mining insects by their characteristic feeding, tunnel through the tissues of leaves, stems and flower buds of economically important plants or crops, of forest vegetable, oil seed and fruit. They deprive the leaves of their chlorophyll, which effects their photosynthesis. In the event of heavy attacks, complete defoliation of these plants is caused due to wilting and loss of vigour, resulting in poor yield and malformation of fruit.

These leaf-mining insects under natural environment of Kashmir have been found to be regulated by a number of natural enemies, viz; parasites and predators. The present study aims to explore this naturally occurring beneficial fauna of biological control and study their biology and select some effective species for developing biological control strategy of these pests under Kashmir ecosystem.

## **Survey and Bioecological Studies on Aphidophagous Fauna with Reference to Biological Control** ( *N. D. Rishi & M. A. Loan* )

Aphids or plant lice are known to be the worst insect pest for all types of vegetation. Because of their peculiar reproduction capacity they are capable of reaching high densities in a short duration in the temperate climate of the Kashmir valley. On severe infestations, besides causing heavy losses, the plant becomes susceptible to sooty moulds. These aphids have been recognised as the chief vectors to transmit viral diseases of dreadful nature to crops. In natural environment these aphids have been found to acquire resistance and are seldom controlled by insecticides. However, some natural biotic agents are capable of bringing desirable decline of aphid population in the agro-ecosystem. A number of such natural enemies have been determined and are being utilized for the natural biological control of these pests, so that use of insecticides could be integrated and natural bio-control is potentiated in the environment of the valley for their control.



**M. Phil / Ph.D. Projects in CORD**

(Supervisor : Prof. J. Shankar)

1. Analysis and characterisation of the constituents of some toxic plants (Beena Bakshi, M. Phil. awarded).
2. Phytochemical investigation of some medicinal plants of the valley (Ph. D thesis, work in progress)

(Supervisor : Dr. A. M. Shah )

3. Studies on Pathogenic Fungi of Rosaceae  
(G. N. Qasba, M. Phil. awarded)
4. Powdery mildew disease on rosaceous fruit yielding plants of Kashmir  
(Anil Dhar, M. Phil. awarded)
5. Studies on regeneration of plants from Tissue Culture.  
(Azra N. Kamili, M. Phil. awarded)
6. Some aspects of Epidemiology and Control of apple scab in Kashmir Valley.  
(Ph.D. work, thesis will be submitted this year)
7. Studies on apple powdery mildew and its Control in Kashmir Valley.  
(Ph.D. work in Progress)
8. In-vitro studies on mulberry species of Kashmir Valley.  
(Ph. D. work in proress)
9. Leaf Curl diseases on stone fruits of Kashmir Valley.  
(M. Phil. work in progress)
10. Leaf spot diseases of important crops of Kashmir Valley.  
(M. Phil. work in progress)
11. Regeneration of Conifers via Tissue Culture.  
(M. Phil. work in Progress)

(Supervisor : Dr. D. P. Zutshi)

12. Phytoplakton photosynthesis, nutrient dynamics and trophic

statua of Manasbal lake, Kashmir.

(A. Wanganeo, Ph. D. awarded)

13. Ecology of polluted and nonpolluted areas of the Dal and Anchar lakes. (A. U. Khan, M. Phil completed)

14. Phosphorus dynamics in Hazratbal basin of Dal Lake. (Reyaz A. Kango, M. Phil completed)

15. Periphyton dynamics in Waskur lake, Koshmir. (S. G. Sarwar, M. Phil completed)

16. Phytoplankton production measurement using C-14, plankton population and environmental factors of two interconnected basins of Dal Lake. (N. A. Mufti, M. Phil completed)

Ph. D. and M. Phil (Supervisor Dr. N. D. Rsshi)

1. Studies on the Taxonomy, Distribution, Biology and Bioecological Control of Phytophagous Mites, of Economic plants.

(Ph. D. thesis A. D. Rather)

2. Biocenological investigations of soil meso fauna of Agricultural and sub-mountain lands of the Kashmir valley.

(M. Phil thesis G. M. Mir)

3. Faunistic Survey and Bioecology of aquatic insects of Dal-lake and their correlation with fish productivity.

(M. Phil thesis B. A. Wani)

4. Survey and studies on the Biology of leaf mining insect pests of some Economic Plants with Reference to Biological Control

(M. Phil thesis, A. R. Bhat)

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1. A. M. Shah and G. N. Dar (1980) *Coleroa Circinans* - A new addition to Indian Mycoflora *Goobios* 7 : 33 - 34.

2. G. N. Dar and A. M. Shah (1980) Three new additions to Indian fungi Indian Phytopathology 33 (4) : 608 - 609.
3. Zutshi, D. P., B. A. Subla, M. A. Khan and A. Wanganeeo (1980) Comparative limnology of nine lakes of Jammu and Kashmir Himalayas. Hydrobiologie, 80 : 101 - 112.
4. Khan, M. A. and D. P. Zutshi (1980) Primary productivity and trophic status of a Kashmir Himalayan lake. Hydrobiologia, 68 : 3 - 8.
5. Zutshi, D. P., A. Wanganeeo and Rajni Raina (1980) Limnology of a Man-made lake. Geobios. 7 : 320 - 324.
6. Khan, M. A. and D. P. Zutshi (1980) Contribution to high altitude limnology of Himalayan system-1. Limnology and primary productivity of plant community of Nilnag lake. Hydrobiologia. 75 : 103 - 112.
7. A Wanganeeo & Rajni Raina. Flushing rate—A Causative factor in lake eutrophication (Symp. Advances in Life sciences in J & K State, Oct, 21-23, 1981).
8. A Wanganeeo & D.P. Zutshi (1982) Diurnal variation in hydrobiological characteristics of a Himalayan lake (in press) Journal of Science, Kashmir University.
9. A. M. Shah and G. N. Qasba (1981) A new leaf spot of *Juglans regia* from India, Science and Culture 37 (4). 100 - 101.
10. A. M. Shah and G. N. Qasba (1980) Some new records of powdery mildew from India. Indian phytopathology 33 (2) : 320 - 321.



11. **G. N. Qasba and A. M. Shah (1981)** Two unrecorded plant diseases from India. *Indian phytopath.* 34 (3): 390 - 393
12. **G. N. Qasba and A. M. Shah (1982)** In-vitro efficacy of some fungicides on inhibition of ascospore discharge in *Venturia inaequalis* (oke) Wint. *Current Scicence* 51 (6) 299 - 300
13. **Anil Dhar and A.M. Shah.** Some new records of powdery mildews *Indian Phytopath* 35 (3) 1982.
14. **Rishi, N. D. & 1981** On a new species of Root infesting aphid Genus *Pratrema* (Homoptera-Aphidiidan) from Kashmir. *Entomon* 6 (2) : 123-124 *Kerala.*

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2. **Anil Dhar, Azra Kamil and A. M. Shah (1982)** Three new host records of powdery mildews from India. (*Indian phytopathology* published in March Issue).
3. **G. N. Qasba and A. M. Shah.** Four fungal diseases now to Jammu and Kashmir (Accepted in *J. Kash. Sci.*)

4. Anil Dhar and A. M. Shah. Two new records of mildew from J & K (Accepted in Kash. Sci.).
5. G. N. Dar and A M Shah Three eperculate Discomycetes from Kashmir Valley (Accepted in J&Kash. Sci.)
6. Azra N Kamili, A. M. Shah In-vitro studies on mulberry species (Accepted in J & Kash. Sci.).
7. Subla, B. A, A. Wanganeo, Rajni Raina, Nirja Vishin and D. P. Zutshi Studies on Zooplankton of Jammu and Kashmir. S. M. Das Comm. Volume (In press).
8. Zutshi, D. P. and A Wangneo. Evidence for Man-made eutrophication of rural lakes. Internat. Sym. Tropical Rural Ecosystems. A. P. S. University, Rewa (In press).
9. Zutshi, D. P., M. A. Khan and A. Wanganeo. Phytoplankton photosynthesis and energy flux in some aquatic ecosystems. Sym. Dynamics of energy flow in biological systems. Saurashtra University, Rajkot (In press).
10. Zutshi, D. P. and A. Wangneo (1981) Nutrient dynamics and trophic evolution of three subtropical lakes. Silver Jubilee Sym. Internat. Soc. Trop. Ecol. P. 308 (Full paper in press).
11. G. N. Qasba, G. N. Dar and A. M. Shah. Scab of *Cotoneaster aitchinsoni* caused by *Venturia inaequalis* (Communicated to Indian phytopath.)
12. G. N. Qasba and A. M. Shah. *Oenothera drummendi* - HK. A new host for *synchytrium fulgens* (Communicated to Indian phytopath.)

13. A. M. Shah, G. N. Qasba and G. N. Dar. Fungi of Jammu and Kashmir - A check list (in process)
14. Zutshi, D. P. and K. K. Vass. Limnological studies on Dal lake  
111. Biological features. Proc. Indian Natl. Sci. Acad. (in press).
15. Raina, Rajni, B. A. Subla and D. P. Zutshi. Water quality and plankton ecology of Jhelum river. Int. J. Ecol. Environ. Sci. (in press)
16. Vass, K. K. and D. P. Zutshi. Limnological studies on Dal lake IV. Energy flow, trophic evolution and ecosystem restoration. Arch. Hydrobiol. (in press).
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20. G. N. Qasha and A. M. Shah. A survey report on apple scab in Kashmir Valley. (Symp. Advances in life Sciences in J & K State, Oct 21-23, 1981)
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22. Azra N. Kamili and A. M. Shah. Preliminary in-vitro studies of Mulberry species. (Symp. Advances in life Sciences in J & K State, Oct, 21-23, 1981).
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  24. Anil Dhar and A. M. Shah. Effect of post-harvest sprays on the incidence of Apple Powdery mildew (3rd International Symposium on Plant Pathology-Dec, 14-18, 1981 IARI New Delhi PP. 149-150).
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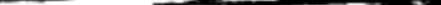
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